

Spartanburg, S. C., 11th; and Titusville, Fla., 24th. Neither were solar halos of frequent occurrence, only a few stations reporting them on scattering dates.

25th-31st.—In the states east of the Mississippi River lunar halos were reported from numerous stations, and solar halos were quite frequent in the Southern States. It was during this period that the tropical storm, described under areas of low pressure as number viii., passed from the region of the West Indies to the east Gulf states.

The phases of the moon, Washington mean time, during July, as given in "The American Ephemeris and Nauti-

cal Almanac" for 1887, are as follows: Full moon, 4th, 15 h. 25.9 m.; last quarter, 12th, 13 h. 48.8 m.; new moon, 20th, 3 h. 41.8 m.; first quarter, 26th, 21 h. 22.1 m.; apogee, 11th, 13.4 h.; perigee, 23d, 12.9 h.

MIRAGE.

Moorhead, Minn.: a mirage was observed at daybreak on the 22d; the outlines of the shores of two lakes lying about twenty miles east of this place were plainly seen.

Mirage was also reported to have been observed during the month, as follows: Vashon, Wash., 9th, 10th; Reidsville, N. C., 18th; Oswego, N. Y., 24th.

MISCELLANEOUS PHENOMENA.

FOREST AND PRAIRIE FIRES.

Wellsborough, Tioga Co., Pa.: on the 11th and 12th about 4,000 acres of forest and partially cleared land in the vicinity of Gaines, in this county, were burned over. About five hundred cords of bark, several million feet of timber and lumber, a railway trestle, and several cars were destroyed.

Fort Spokane, Wash.: on the 13th and 14th fires were burning east and south of this station.

Helena, Mont.: fires were burning in the woods thirty-five miles north of this place on the 21st.

Forest and prairie fires are also reported to have occurred as follows:

Linkville, Oregon, 1st to 14th.

Fort Reno, Ind. T., 7th.

Fort Klamath, Oregon, 15th.

INSECTS.

Perham, Otter Tail Co., Minn.: a large amount of damage has been done by locusts to the crops in this county. In some places these insects have eaten everything except wild grass and the foliage of trees.

Saint Paul, Minn., 7th: reports from various localities in southern Minnesota state that crops of all kinds have been injured by chinch bugs. At about midnight on the 13-14th, swarms of insects known as "day bugs" or "swamp bugs," infested the city, obscuring the gas lamps and covering the streets and pavements in many places from six inches to one foot deep. These insects disappeared after sunrise on the 14th.

Omaha, Nebr., 11th: reports from several sections of this state show that chinch bugs are causing serious injury to wheat, oats, and corn.

Quakertown, Bucks Co., Pa., 16th: during the earlier part of the month some injury was done by potato bugs and caterpillars in this county.

Morse, Johnson Co., Kans., 17th: chinch bugs are beginning to do injury in this locality; potato bugs have also appeared to some extent.

Mason City, Cerro Gordo Co., Iowa.: during a part of the afternoon of the 19th large swarms of chinch bugs filled the air so as to render walking in the streets very disagreeable.

Saint Peter, Nicollet Co., Minn.: large numbers of chinch bugs appeared in this vicinity on the 19th.

Campton, Kane Co., Ill., 22d: grasshoppers have injured the corn crop in this county.

Manhattan, Riley Co., Kans., 30th: chinch bugs have done considerable damage in this locality.

Humphrey, Cattaraugus Co., N. Y., 30th: grasshoppers are very numerous in this county.

Forsyth, Monroe Co., Ga., 31st: cotton worms are doing injury to cotton.

Embarras, Waupaca Co., Wis., 31st: chinch bugs are very numerous in this locality.

METEORS.

Earleton, Alachua Co., Fla.: two meteors were observed on the evening of the 11th; the first was seen falling due south at 8.30 p. m., and appeared as a large red ball, which separated into two parts, both disappearing before reaching the hori-

zon. The second meteor fell in a curve from north to southeast at 8.50 p. m.; beginning small, it grew rapidly larger and disappeared behind a cloud, but, by the bright light around the edges of the cloud, the observer could time the point of explosion.

Graud Junction, Greene Co., Iowa: a large meteor was observed at 8.30 p. m. on the 25th; it started in the northern sky and traveled due west for about 30°, leaving a bright trail in its path.

Topeka, Kans.: a large meteor was reported to have been observed at about 9 p. m. on the 25th; it was first seen in altitude 35° and azimuth 330°, having a slow and wavy motion, which the observer states resembled that of a ball when tied up in a handkerchief and thrown.

Des Moines, Iowa: an unusually bright meteor was observed at 9.30 p. m. on the 25th; it started at a point about 40° east of south, shot across the heavens at an altitude of about 30°, and disappeared when about 35° west of south.

Delaware, Walworth Co., Wis.: a large meteor was observed in the western sky at 8 p. m. on the 25th; it fell in a north-westerly direction, leaving a train of sparks.

Dubuque, Iowa: a meteor passed over this city from southeast to northeast at 12.05 a. m. on the 27th, leaving a bright trail which remained visible several seconds.

Cairo, Ill.: a brilliant display of meteors was observed in the western sky in altitude about 50°, between 12.30 and 1.00 a. m. on the 27th.

East Portland, Oregon: a very brilliant meteor was seen at midnight on the 29th; it moved in an easterly direction and exploded in the northeastern sky.

Meteors were also observed during the month on the following dates:

1st, Elkin, Ky.; Beverly, N. J. 2d, Vevay, Ind. 3d and 4th, Elkin, Ky. 5th, Manatee, Fla. 6th, Elkin, Ky. 7th, Clayton, N. J. 8th, Kalamazoo, Mich.; Quakertown, Pa. 9th, Beverly, N. J. 10th, Concord and Nashua, N. H. 11th, Duke and Archer, Fla.; Nashua, N. H. 12th, Independence, Iowa; Nashua and Concord, N. H. 13th, Stateburg, S. C.; Nashua and Concord, N. H. 14th, Keeler, Cal.; Dudley, Mass. 15th, Charleston and Pekin, Ill. 16th, Archer, Fla. 17th, Manatee, Fla.; Charleston, Ill. 19th, Charleston, Ill. 21st, Manatee, Fla. 25th, Davenport, Iowa; New Midway, Md.; Beverly, N. J. 26th, Delavan, Wis. 27th, Davenport, Iowa. 28th, Butlerville, Ind.; Independence, Iowa. 29th, Davenport, Iowa; Kalamazoo, Mich.; 30th, Davenport, Iowa; Kalamazoo, Mich.

MIGRATION OF BIRDS.

The Voluntary observer at Elkin, Clark Co., Ky., reports ducks flying northward on the 6th.

SUN SPOTS.

Mr. H. D. Govey, of North Lewisburg, Champaign Co., Ohio, reports having observed sun spots on the following dates: 1st to 3d, 5th to 7th, 10th to 16th, 23d to 30th; four large spots were observed on the 10th, extending in a straight line nearly across the centre of the sun.

SAND STORMS.

Sand storms were reported during the month, as follows:

San Carlos, Ariz., 3d; Fort McDowell, Ariz., 3d to 6th; Fort Mojave, Ariz., 4th to 7th; Rio Grande City, Tex., 29th, 30th.

VERIFICATIONS.

INDICATIONS.

The detailed comparison of the tri-daily indications for July, 1887, with the telegraphic reports for the succeeding thirty-two hours, shows the general average percentage of verifications to be 67.68.* The percentages for the different elements are: Weather, 67.52;* wind, 65.96;* temperature, 68.31.* By states, etc., the percentages are: For Maine, 59.52; New Hampshire, 63.82; Vermont, 61.18; Massachusetts, 66.28; Rhode Island, 75.75; Connecticut, 66.10; eastern New York, 61.23; western New York, 68.49; eastern Pennsylvania, 63.26; western Pennsylvania, 66.07; New Jersey, 67.84; Delaware, 65.00; Maryland, 66.62; District of Columbia, 66.22; Virginia, 64.60; North Carolina, 70.92; South Carolina, 71.46; Georgia, 69.98; eastern Florida, 68.74; western Florida, 70.91; Alabama, 69.94; Mississippi, 68.97; Louisiana, 71.38; eastern Texas, 81.68; Arkansas, 66.97; Tennessee, 60.85; Kentucky, 67.11; Ohio, 73.22; West Virginia, 76.05; Indiana, 75.61; Illinois, 77.63; lower Michigan, 69.10; upper Michigan, 64.08; Wisconsin, 65.04; Minnesota, 66.23; Iowa, 70.66; Kansas, 67.54; Nebraska, 55.06; Missouri, 76.28; Colorado, 58.23; eastern Dakota, 59.68; Washington Territory, 80.80; Oregon, 85.04; northern California, 91.61; southern California, 93.44.

There were fifteen omissions to predict out of 8,529, or 0.18 per cent. Of the 8,514 predictions that have been made, eight hundred and thirty-seven, or 9.83 per cent., are considered to have entirely failed; seven hundred and thirty-three, or 8.61 per cent., were one-fourth verified; 2,018, or 23.70 per cent., were one-half verified; 1,565, or 18.38 per cent., were three-fourths verified; 3,361, or 39.48 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

The predictions for all districts east of the Rocky Mountains for July, 1887, were made by 2d Lieutenant John P. Finley, Signal Corps, Assistant, except from the 17th, 3 p. m., to the 19th, 10 p. m., inclusive, when they were made by 2d Lieutenant F. M. M. Beall, Signal Corps, Assistant; those for the Pacific coast districts were made by 2d Lieutenant J. E. Maxfield, Signal Corps, Assistant; the verifications were determined by 1st Lieutenant Robert Craig, 4th Artillery, Acting Signal Officer and Assistant.

CAUTIONARY SIGNALS.

Of the total number of signals ordered during July, 1887, it was practicable to determine the justification or failure of seventy-five; of these, twenty-six, or 34.66 per cent., were fully justified both as to direction and velocity. Number of signals ordered for southeast winds, five; fully justified both as to direction and velocity, three, or 60.00 per cent. Number of signals ordered for southwest winds, twenty-two; fully verified both as to direction and velocity, ten, or 45.45 per cent. Number of signals ordered for northwest winds, six;

* In determining the general average percentage and the percentages for the different elements, the Pacific coast states have not been included.

fully verified both as to direction and velocity, five, or 83.33 per cent. Number of signals ordered without regard to direction, forty-two; verified, eight, or 19.05 per cent. Number of signals ordered late, i. e., after justifying velocity had begun, one, or 1.33 per cent.

In addition to the above, there were ordered at display stations sixty-nine signals, the verification of which it was impracticable to determine.

In forty-two instances winds were reported which would have justified the display of cautionary signals, but for which no signals were ordered, and in eleven instances winds which would have justified the display of on-shore signals, but for which no signals were ordered. The display of on-shore signals was discontinued on July 13th.

No cold-wave signals were ordered during the month.

LOCAL VERIFICATIONS.

The following is from the report of the "Michigan State Weather Service" for July, 1887:

Weather signals are now displayed in one hundred and thirty-two towns in the state, and are very favorably commented on. The prediction of the weather for the twenty-four hours from 7 a. m. to 7 a. m. has been verified during July as follows (the verification is taken from reports of displaymen furnished monthly to this office): temperature, 82.9 per cent.; weather, 85.7 per cent.; temperature and weather, 84.3 per cent.

The weather and temperature signals are now carried on the baggage cars of the following roads: D., G. H. & M. R'y., C. & G. T. R'y., Port Huron Division G. T. R'y., P. H. & N. R'y., the Michigan Central R'y. System, G. R. & I. R'y., and the Chicago and West Michigan R'y. The first trains leaving the terminal points carry the signals, and there are now twenty-five trains on these different roads that carry the signals, and cover a very large portion of the agricultural district of the state, and bring the benefits of the service within reach of the farmers along the line of these roads daily, and many favorable comments are made on the benefits derived.

The percentage of verification of weather predictions for July on the D., G. H., and M. R'y., is 84.7 for weather and 83.3 for temperature; on the C. & G. T. R'y., weather, 81.3, and temperature, 79.7; P. H. & N. R'y., weather, 85.0, and temperature, 84.7. The other roads have not been carrying the signals sufficient time to compute the percentage.

The following is from the July, 1887, report of the "Minnesota Weather Service:"

Verifications of weather signals for Minnesota were 77 per cent. for weather and 75 per cent. for temperature; for eastern Dakota, 85 per cent. for weather and 88 per cent. for temperature.

The following is from the July, 1887, report of the "South Carolina Weather Service:"

The percentage of verification of the weather and temperature predictions for the whole state was: for weather, 84.8 per cent.; for temperature, 94.6 per cent.

The following is from the July, 1887, report of the "Tennessee State Board of Health Bulletin:"

The percentage of verification of the temperature and weather predictions during the month at Fayetteville and Clarksville were as follows: Fayetteville, temperature, 100 per cent.; weather, 71.0 per cent.; Clarksville, temperature, 87.1 per cent.; weather, 55.0 per cent.

STATE WEATHER SERVICES.

The following extracts are republished from the reports for July, 1887, of the directors of the various state weather services:

The "Arkansas Weather Service," W. U. Simons, Signal Corps, director:

The month was marked by numerous local rain storms, which were distributed in a partial manner, some parts of the state having abundant daily rains, others only at intervals of several days, and in some localities only one or two sprinkles during the month, so that the total amount ranged from 8.7 inches to only .04 of an inch. These rains did not appear in belts, and it would be difficult to precisely define their location. The greatest amount of rain fell at

Forrest City, in the eastern part of the state, while the next largest amount was reported from Pine Bluff in the central part, and the least at Malvern, also centrally located.

The temperature was apparently above the average at most points, but more particularly in the central and northern portions than in the southern. The temperature reached or passed 90° on over twenty days of the month at all stations except Eureka Springs, where it reached 90° on three days; at Conway on fourteen days; Portia, fifteen days; Buck's Range, seventeen days; Washington and De Vall's Bluff, each on eighteen days.